



SEQUENCE LISTING

<110> Matsui, Ikuo
Ishikawa, Kazuhiko
Ishida, Hiroyasu
Kosugi, Yoshitsugu

<120> THERMOPHILIC ENZYMES HAVING
BETA-GLYCOSIDASE ACTIVITY

<130> 11059/002001

<140> 09/369,735

<141> 1999-08-06

<160> 10

<170> FastSEQ for Windows Version 4.0

<210> 1

<211> 1269

<212> DNA

<213> Pyrococcus horikoshii

<220>

<221> CDS

<222> (1)...(1269)

<400> 1

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1				5					10					15		

tcc	cat	cag	ata	gag	gga	aat	aat	aga	tgg	aat	gat	tgg	tgg	tac	tat	96
Ser	His	Gln	Ile	Glu	Gly	Asn	Asn	Arg	Trp	Asn	Asp	Trp	Trp	Tyr	Tyr	
			20					25					30			

gag	cag	att	gga	aag	ctc	ccc	tac	aga	tct	ggt	aag	gct	tgc	aat	cac	144
Glu	Gln	Ile	Gly	Lys	Leu	Pro	Tyr	Arg	Ser	Gly	Lys	Ala	Cys	Asn	His	
			35				40					45				

tgg	gaa	ctt	tac	agg	gat	gat	att	cag	cta	atg	acc	agc	ttg	ggc	tat	192
Trp	Glu	Leu	Tyr	Arg	Asp	Asp	Ile	Gln	Leu	Met	Thr	Ser	Leu	Gly	Tyr	
	50					55					60					

aat	gct	tat	agg	ttc	tcc	ata	gag	tgg	agc	agg	cta	ttc	cca	gag	gaa	240
Asn	Ala	Tyr	Arg	Phe	Ser	Ile	Glu	Trp	Ser	Arg	Leu	Phe	Pro	Glu	Glu	
	65				70				75					80		

aat	aaa	ttt	aat	gaa	gat	gct	ttc	atg	aaa	tac	cgg	gag	att	ata	gac	288
Asn	Lys	Phe	Asn	Glu	Asp	Ala	Phe	Met	Lys	Tyr	Arg	Glu	Ile	Ile	Asp	
			85					90						95		

ttg	tta	ttg	acg	aga	ggt	ata	act	ccc	ctg	gtg	acc	cta	cac	cac	ttt	336
Leu	Leu	Leu	Thr	Arg	Gly	Ile	Thr	Pro	Leu	Val	Thr	Leu	His	His	Phe	
			100					105					110			

act	agc	cct	ctc	tgg	ttc	atg	aag	aaa	ggt	ggc	ttc	ctt	agg	gag	gag	384
Thr	Ser	Pro	Leu	Trp	Phe	Met	Lys	Lys	Gly	Gly	Phe	Leu	Arg	Glu	Glu	
			115				120					125				

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MAY 14 2001

TECH CENTER 1600/2900

aac cta aaa cat tgg gaa aag tac ata gaa aag gtt gct gag ctt tta	432
Asn Leu Lys His Trp Glu Lys Tyr Ile Glu Lys Val Ala Glu Leu Leu	
130 135 140	
gaa aaa gtt aaa cta gta gct acc ttc aat gag ccg atg gta tac gta	480
Glu Lys Val Lys Leu Val Ala Thr Phe Asn Glu Pro Met Val Tyr Val	
145 150 155 160	
atg atg gga tat cta acg gct tat tgg ccc cca ttc att agg agt cca	528
Met Met Gly Tyr Leu Thr Ala Tyr Trp Pro Pro Phe Ile Arg Ser Pro	
165 170 175	
ttt aag gcc ttt aag gta gct gca aac ctg ctt aaa gct cac gca att	576
Phe Lys Ala Phe Lys Val Ala Ala Asn Leu Leu Lys Ala His Ala Ile	
180 185 190	
gcc tat gaa ctt ctt cat ggg aaa ttc aaa gtt gga atc gta aag aat	624
Ala Tyr Glu Leu Leu His Gly Lys Phe Lys Val Gly Ile Val Lys Asn	
195 200 205	
att ccc ata ata ctc cca gcg agt gac aag gag agg gat aga aaa gcc	672
Ile Pro Ile Ile Leu Pro Ala Ser Asp Lys Glu Arg Asp Arg Lys Ala	
210 215 220	
gct gag aaa gct gat aat tta ttt aac tgg cac ttt ttg gat gcg ata	720
Ala Glu Lys Ala Asp Asn Leu Phe Asn Trp His Phe Leu Asp Ala Ile	
225 230 235 240	
tgg agt ggg aaa tac aga ggg gta ttt aaa aca tat agg att ccc caa	768
Trp Ser Gly Lys Tyr Arg Gly Val Phe Lys Thr Tyr Arg Ile Pro Gln	
245 250 255	
agt gac gca gat ttc att ggg gtt aac tat tac acg gcc agc gaa gta	816
Ser Asp Ala Asp Phe Ile Gly Val Asn Tyr Tyr Thr Ala Ser Glu Val	
260 265 270	
agg cat act tgg aat cct tta aaa ttc ttc ttt gag gtg aaa tta gcg	864
Arg His Thr Trp Asn Pro Leu Lys Phe Phe Phe Glu Val Lys Leu Ala	
275 280 285	
gat att agc gag agg aag act caa atg gga tgg agc gtt tat cca aaa	912
Asp Ile Ser Glu Arg Lys Thr Gln Met Gly Trp Ser Val Tyr Pro Lys	
290 295 300	
gga ata tac atg gcc ctt aaa aaa gct tcc agg tat gga agg cct ctt	960
Gly Ile Tyr Met Ala Leu Lys Lys Ala Ser Arg Tyr Gly Arg Pro Leu	
305 310 315 320	
tat att acg gaa aac gga ata gcg acg ctt gat gat gaa tgg aga gtg	1008
Tyr Ile Thr Glu Asn Gly Ile Ala Thr Leu Asp Asp Glu Trp Arg Val	
325 330 335	
gaa ttc ata att caa cac ctc caa tac gtt cat aag gct atc gaa gac	1056
Glu Phe Ile Ile Gln His Leu Gln Tyr Val His Lys Ala Ile Glu Asp	
340 345 350	
ggc ctg gat gta aga ggt tac ttc tat tgg tca ttt atg gat aac tac	1104
Gly Leu Asp Val Arg Gly Tyr Phe Tyr Trp Ser Phe Met Asp Asn Tyr	
355 360 365	

gag tgg aaa gag ggg ttt ggg cct aga ttt ggc cta gtg gaa gtt gat	1152
Glu Trp Lys Glu Gly Phe Gly Pro Arg Phe Gly Leu Val Glu Val Asp	
370 375 380	
tat caa acc ttc gag aga agg ccc agg aag agt gct tac gta tac gga	1200
Tyr Gln Thr Phe Glu Arg Arg Pro Arg Lys Ser Ala Tyr Val Tyr Gly	
385 390 395 400	
gaa att gca aga agt aag gaa ata aag gat gag cta tta aag aga tat	1248
Glu Ile Ala Arg Ser Lys Glu Ile Lys Asp Glu Leu Leu Lys Arg Tyr	
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ggc cta cca gaa ctt caa ctt	1269
Gly Leu Pro Glu Leu Gln Leu	
420	

<210> 2

<211> 423

<212> PRT

<213> Pyrococcus horikoshii

<400> 2

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Glu Gln Ile Gly Lys Leu Pro Tyr Arg Ser Gly Lys Ala Cys Asn His	
35 40 45	
Trp Glu Leu Tyr Arg Asp Ile Gln Leu Met Thr Ser Leu Gly Tyr	
50 55 60	
Asn Ala Tyr Arg Phe Ser Ile Glu Trp Ser Arg Leu Phe Pro Glu Glu	
65 70 75 80	
Asn Lys Phe Asn Glu Asp Ala Phe Met Lys Tyr Arg Glu Ile Ile Asp	
85 90 95	
Leu Leu Leu Thr Arg Gly Ile Thr Pro Leu Val Thr Leu His His Phe	
100 105 110	
Thr Ser Pro Leu Trp Phe Met Lys Lys Gly Gly Phe Leu Arg Glu Glu	
115 120 125	
Asn Leu Lys His Trp Glu Lys Tyr Ile Glu Lys Val Ala Glu Leu Leu	
130 135 140	
Glu Lys Val Lys Leu Val Ala Thr Phe Asn Glu Pro Met Val Tyr Val	
145 150 155 160	
Met Met Gly Tyr Leu Thr Ala Tyr Trp Pro Pro Phe Ile Arg Ser Pro	
165 170 175	
Phe Lys Ala Phe Lys Val Ala Ala Asn Leu Leu Lys Ala His Ala Ile	
180 185 190	
Ala Tyr Glu Leu Leu His Gly Lys Phe Lys Val Gly Ile Val Lys Asn	
195 200 205	
Ile Pro Ile Ile Leu Pro Ala Ser Asp Lys Glu Arg Asp Arg Lys Ala	
210 215 220	
Ala Glu Lys Ala Asp Asn Leu Phe Asn Trp His Phe Leu Asp Ala Ile	
225 230 235 240	
Trp Ser Gly Lys Tyr Arg Gly Val Phe Lys Thr Tyr Arg Ile Pro Gln	
245 250 255	
Ser Asp Ala Asp Phe Ile Gly Val Asn Tyr Tyr Thr Ala Ser Glu Val	
260 265 270	
Arg His Thr Trp Asn Pro Leu Lys Phe Phe Phe Glu Val Lys Leu Ala	
275 280 285	
Asp Ile Ser Glu Arg Lys Thr Gln Met Gly Trp Ser Val Tyr Pro Lys	
290 295 300	

Gly Ile Tyr Met Ala Leu Lys Lys Ala Ser Arg Tyr Gly Arg Pro Leu
 305 310 315 320
 Tyr Ile Thr Glu Asn Gly Ile Ala Thr Leu Asp Asp Glu Trp Arg Val
 325 330 335
 Glu Phe Ile Ile Gln His Leu Gln Tyr Val His Lys Ala Ile Glu Asp
 340 345 350
 Gly Leu Asp Val Arg Gly Tyr Phe Tyr Trp Ser Phe Met Asp Asn Tyr
 355 360 365
 Glu Trp Lys Glu Gly Phe Gly Pro Arg Phe Gly Leu Val Glu Val Asp
 370 375 380
 Tyr Gln Thr Phe Glu Arg Arg Pro Arg Lys Ser Ala Tyr Val Tyr Gly
 385 390 395 400
 Glu Ile Ala Arg Ser Lys Glu Ile Lys Asp Glu Leu Leu Lys Arg Tyr
 405 410 415
 Gly Leu Pro Glu Leu Gln Leu
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<210> 3
 <211> 57
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> An upper primer designed to create the NdeI site.

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57

<210> 4
 <211> 46
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> A lower primer designed to create the BamHI site.

<400> 4
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46

<210> 5
 <211> 423
 <212> PRT
 <213> Pyrococcus horikoshii

<400> 5
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 Ser Lys Cys Ile Glu Gly Asn Asn Arg Trp Asn Cys Trp Trp Tyr Tyr
 20 25 30
 Glu Gln Ile Gly Lys Leu Pro Tyr Arg Ser Gly Lys Ala Cys Asn His
 35 40 45
 Trp Glu Leu Tyr Arg Asp Asp Ile Gln Leu Met Thr Ser Leu Gly Tyr
 50 55 60
 Asn Ala Tyr Arg Phe Ser Ile Glu Trp Ser Arg Leu Phe Pro Glu Glu
 65 70 75 80
 Asn Lys Phe Met Glu Asp Ala Phe Met Lys Tyr Arg Glu Ile Ile Asp
 85 90 95
 Leu Leu Leu Thr Phe Gly Ile Thr Pro Leu Val Thr Leu His His Phe
 100 105 110
 Thr Ser Pro Leu Trp Phe Met Lys Lys Gly Gly Phe Leu Arg Glu Glu
 115 120 125

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Asn Leu Lys His Trp Glu Lys Tyr Ile Glu Lys Val Ala Glu Leu Leu
 130                      135                      140
Glu Lys Val Lys Leu Val Ala Thr Phe Asn Glu Pro Met Val Tyr Val
145                      150                      155                      160
Met Met Gly Tyr Leu Thr Ala Tyr Trp Pro Pro Phe Ile Arg Ser Pro
                      165                      170                      175
Phe Lys Ala Phe Lys Val Ala Ala Asn Leu Leu Lys Ala His Ala Ile
                      180                      185                      190
Ala Tyr Glu Leu Leu His Gly Lys Phe Lys Val Gly Ile Val Lys Asn
                      195                      200                      205
Ile Pro Ile Ile Leu Pro Ala Ser Asp Lys Glu Arg Asp Arg Lys Ala
                      210                      215                      220
Ala Glu Lys Ala Asp Asn Leu Phe Asn Trp His Phe Leu Asp Ala Ile
225                      230                      235                      240
Trp Ser Gly Lys Tyr Arg Gly Val Phe Lys Thr Tyr Arg Ile Pro Gln
                      245                      250                      255
Ser Asp Ala Asp Phe Ile Gly Met Asn Tyr Tyr Thr Ala Ser Glu Val
                      260                      265                      270
Arg His Thr Trp Asn Pro Leu Lys Phe Phe Phe Glu Val Lys Leu Ala
                      275                      280                      285
Asp Ile Ser Glu Arg Lys Thr Gln Met Gly Trp Ser Val Tyr Pro Lys
                      290                      295                      300
Gly Ile Tyr Met Ala Leu Lys Lys Ala Ser Pro Tyr Gly Arg Pro Leu
305                      310                      315                      320
Tyr Ile Thr Glu Asn Gly Ile Ala Thr Leu Asp Asp Glu Trp Arg Val
                      325                      330                      335
Glu Phe Ile Ile Gln His Leu Gln Tyr Val His Lys Ala Ile Glu Asp
                      340                      345                      350
Gly Leu Asp Val Arg Gly Tyr Phe Tyr Trp Ser Phe Met Asp Asn Tyr
                      355                      360                      365
Glu Trp Lys Glu Gly Phe Gly Pro Arg Phe Gly Leu Val Glu Val Asp
                      370                      375                      380
Tyr Gln Thr Phe Glu Arg Arg Pro Arg Lys Ser Ala Tyr Val Tyr Gly
385                      390                      395                      400
Glu Ile Ala Arg Ser Lys Glu Ile Lys Asp Glu Leu Leu Lys Arg Tyr
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Gly Leu Pro Glu Leu Gln Leu
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<210> 6

<211> 483

<212> PRT

<213> *Pyrococcus horikoshii*

<400> 6

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                      20                      25                      30
Trp Val Arg Asp Pro Tyr Asn Ile Lys Asn Asp Leu Val Ser Gly Asp
                      35                      40                      45
Leu Pro Glu Glu Gly Ile Asn Asn Tyr Glu Leu Tyr Glu Ile Asp His
50                      55                      60
Arg Leu Ala Lys Glu Leu Gly Leu Asn Ala Tyr Gln Leu Thr Ile Glu
65                      70                      75                      80
Trp Ser Arg Ile Phe Pro Cys Pro Thr Phe Asn Val Glu Val Glu Phe
                      85                      90                      95
Glu Arg Asp Asx Tyr Gly Leu Ile Lys Lys Val Lys Ile Glu Lys Glu
                      100                      105                      110
His Leu Glu Glu Leu Asp Lys Leu Ala Asn Gln Lys Glu Val Arg His
                      115                      120                      125

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Tyr Leu Asn Val Leu Arg Asn Leu Lys Lys Leu Gly Phe Thr Thr Phe
 130 135 140
 Val Thr Leu Asn His Gln Thr Asn Pro Ile Trp Ile His Asp Pro Ile
 145 150 155 160
 Glu Thr Arg Gly Asn Phe Gln Lys Ala Arg Ala Pro Gly Trp Val Asp
 165 170 175
 Glu Arg Thr Ile Ile Glu Phe Ala Lys Tyr Ala Ala Tyr Val Ala Trp
 180 185 190
 Lys Phe Asp Asn Tyr Val Asp Tyr Trp Ser Thr Phe Asp Glu Pro Met
 195 200 205
 Val Thr Ala Glu Leu Gly Tyr Leu Ala Pro Tyr Val Gly Trp Pro Pro
 210 215 220
 Gly Ile Leu Asn Pro Ser Ala Ala Lys Lys Val Ile Ile Asn Gln Ile
 225 230 235 240
 Val Ala His Ala Pro Ala Tyr Asp Ser Ile Lys Lys Phe Ser Ser Lys
 245 250 255
 Pro Val Gly Val Ile Leu Asn Ile Ile Pro Ala Tyr Pro Leu Asp Pro
 260 265 270
 Asn Asp Ser Lys Ser Val Arg Ala Ala Glu Asn Tyr Asp Leu Phe His
 275 280 285
 Asn Arg Leu Phe Leu Glu Ala Val Asn Arg Gly Asn Val Asp Leu Asp
 290 295 300
 Ile Thr Gly Glu Tyr Thr Lys Ile Pro His Ile Lys Arg Asn Asp Trp
 305 310 315 320
 Ile Gly Asn Asn Tyr Tyr Thr Arg Glu Val Val Lys Tyr Val Glu Pro
 325 330 335
 Lys Tyr Glu Glu Leu Pro Leu Ile Thr Phe Val Gly Val Glu Gly Tyr
 340 345 350
 Gly Tyr Ser Gly Asn Pro Asn Ser Leu Ser Pro Asp Asn Asn Pro Thr
 355 360 365
 Ser Asp Phe Gly Trp Glu Val Phe Pro Gln Gly Leu Tyr Asp Ser Thr
 370 375 380
 Leu Glu Ala Ala Glu Tyr Asn Lys Glu Val Phe Ile Thr Glu Asn Gly
 385 390 395 400
 Ile Ala Asp Ser Lys Asp Ile Leu Arg Pro Arg Tyr Ile Ile Asp His
 405 410 415
 Val Asn Glu Val Lys Lys Leu Ile Glu Asn Gly Ile Lys Val Gly Gly
 420 425 430
 Tyr Phe His Trp Ala Leu Thr Asp Asn Tyr Glu Trp Ala Met Gly Phe
 435 440 445
 Lys Ile Arg Phe Gly Leu Tyr Glu Val Asp Leu Ile Thr Lys Glu Arg
 450 455 460
 Ile Pro Arg Arg Arg Ser Val Glu Ile Tyr Lys Lys Ile Val Met Glu
 465 470 475 480
 Gly Ile Glu

<210> 7

<211> 510

<212> PRT

<213> *Pyrococcus furiosus*

<400> 7

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 Phe Glu Met Gly Asp Lys Leu Arg Arg Asn Ile Asp Thr Asn Thr Asp
 20 25 30
 Trp Trp His Trp Val Arg Asp Lys Thr Asn Ile Glu Lys Gly Leu Val
 35 40 45
 Ser Gly Asp Leu Pro Glu Glu Gly Ile Asn Asn Tyr Glu Leu Tyr Glu
 50 55 60

Lys	Asp	His	Glu	Ile	Ala	Arg	Lys	Leu	Gly	Leu	Asn	Ala	Tyr	Arg	Ile	65	70	75	80
Gly	Ile	Glu	Trp	Ser	Arg	Ile	Phe	Pro	Trp	Pro	Thr	Thr	Phe	Ile	Asp	85	90	95	
Val	Asp	Tyr	Ser	Tyr	Asn	Glu	Ser	Tyr	Asn	Leu	Ile	Glu	Asp	Val	Lys	100	105	110	
Ile	Thr	Lys	Asp	Thr	Leu	Glu	Glu	Leu	Asp	Glu	Ile	Ala	Asn	Lys	Arg	115	120	125	
Glu	Val	Ala	Tyr	Tyr	Arg	Ser	Val	Ile	Asn	Ser	Leu	Arg	Ser	Lys	Gly	130	135	140	
Phe	Lys	Val	Ile	Val	Asn	Leu	Asn	His	Phe	Thr	Leu	Pro	Tyr	Trp	Asp	145	150	155	160
His	Asp	Pro	Ile	Glu	Ala	Arg	Glu	Arg	Ala	Leu	Thr	Asn	Lys	Arg	Asn	165	170	175	
Gly	Trp	Val	Asn	Pro	Arg	Thr	Val	Ile	Glu	Phe	Ala	Lys	Tyr	Ala	Ala	180	185	190	
Tyr	Ile	Ala	Tyr	Lys	Phe	Gly	Asp	Ile	Val	Asp	Met	Trp	Ser	Thr	Phe	195	200	205	
Asn	Glu	Pro	Met	Val	Val	Val	Glu	Leu	Gly	Tyr	Leu	Ala	Pro	Tyr	Ser	210	215	220	
Gly	Phe	Pro	Pro	Gly	Val	Leu	Asn	Pro	Glu	Ala	Ala	Lys	Leu	Ala	Ile	225	230	235	240
Leu	His	Met	Ile	Asn	Ala	His	Ala	Leu	Ala	Tyr	Arg	Gln	Ile	Lys	Lys	245	250	255	
Phe	Asp	Thr	Glu	Lys	Ala	Asp	Lys	Asp	Ser	Lys	Glu	Pro	Ala	Glu	Val	260	265	270	
Gly	Ile	Ile	Tyr	Asn	Asn	Ile	Gly	Val	Ala	Tyr	Pro	Lys	Asp	Pro	Asn	275	280	285	
Asp	Ser	Lys	Asp	Val	Lys	Ala	Ala	Glu	Asn	Asp	Asn	Phe	Phe	His	Ser	290	295	300	
Gly	Leu	Phe	Phe	Glu	Ala	Ile	His	Lys	Gly	Lys	Leu	Asn	Ile	Glu	Phe	305	310	315	320
Asp	Gly	Glu	Thr	Phe	Ile	Asp	Ala	Pro	Tyr	Leu	Lys	Gly	Asn	Asp	Trp	325	330	335	
Ile	Gly	Met	Asn	Tyr	Tyr	Thr	Arg	Glu	Val	Val	Thr	Tyr	Gln	Glu	Pro	340	345	350	
Met	Phe	Pro	Ser	Ile	Pro	Leu	Ile	Thr	Phe	Lys	Gly	Val	Gln	Gly	Tyr	355	360	365	
Gly	Tyr	Ala	Cys	Arg	Pro	Gly	Thr	Gln	Ser	Lys	Asp	Asp	Arg	Pro	Val	370	375	380	
Ser	Asp	Ile	Gly	Trp	Glu	Leu	Tyr	Pro	Glu	Gly	Met	Tyr	Asp	Ser	Ile	385	390	395	400
Val	Glu	Ala	His	Lys	Tyr	Gly	Val	Pro	Val	Tyr	Val	Thr	Glu	Asn	Gly	405	410	415	
Ile	Ala	Asp	Ser	Lys	Asp	Ile	Leu	Arg	Pro	Tyr	Tyr	Ile	Ala	Ser	His	420	425	430	
Ile	Lys	Met	Ile	Glu	Lys	Ala	Phe	Glu	Asp	Gly	Tyr	Glu	Val	Lys	Gly	435	440	445	
Tyr	Phe	His	Trp	Ala	Leu	Thr	Asp	Asn	Phe	Glu	Trp	Ala	Leu	Gly	Phe	450	455	460	
Arg	Met	Arg	Phe	Gly	Leu	Tyr	Glu	Val	Asn	Leu	Ile	Thr	Lys	Glu	Arg	465	470	475	480
Ile	Pro	Arg	Glu	Lys	Ser	Val	Ser	Ile	Phe	Arg	Glu	Ile	Val	Ala	Asn	485	490	495	
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<210> 8

<211> 472

<212> PRT

<213> *Pyrococcus furiosus*

<400> 8

Met	Lys	Phe	Pro	Lys	Met	Phe	Met	Phe	Gly	Tyr	Ser	Trp	Ser	Gly	Pro
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Gln	Phe	Glu	Met	Gly	Leu	Pro	Gly	Ser	Glu	Val	Glu	Ser	Asp	Trp	Trp
			20					25					30		
Val	Trp	Val	His	Asp	Lys	Glu	Asn	Ile	Ala	Ser	Gly	Leu	Val	Ser	Gly
		35					40					45			
Asp	Leu	Pro	Glu	Asn	Gly	Pro	Ala	Tyr	Trp	His	Ile	Tyr	Lys	Gln	Asp
	50					55					60				
His	Asp	Ile	Ala	Glu	Lys	Leu	Gly	Met	Asp	Cys	Ile	Arg	Gly	Gly	Ile
65					70					75					80
Glu	Trp	Ala	Arg	Ile	Phe	Pro	Lys	Pro	Thr	Phe	Asp	Val	Lys	Val	Asp
				85					90					95	
Val	Glu	Lys	Asp	Glu	Glu	Gly	Asn	Ile	Ile	Ser	Val	Asp	Val	Pro	Glu
			100					105					110		
Ser	Thr	Ile	Lys	Glu	Leu	Glu	Lys	Ile	Ala	Asn	Met	Glu	Ala	Leu	Glu
		115					120					125			
His	Tyr	Arg	Lys	Ile	Tyr	Ser	Asp	Trp	Lys	Glu	Pro	Gly	Lys	Thr	Phe
	130					135					140				
Ile	Leu	Asn	Leu	Tyr	His	Trp	Pro	Leu	Pro	Leu	Trp	Ile	His	Asp	Pro
145					150					155					160
Ile	Ala	Val	Arg	Lys	Leu	Gly	Pro	Asp	Arg	Ala	Pro	Ala	Gly	Trp	Leu
				165					170					175	
Asp	Glu	Lys	Thr	Val	Val	Glu	Phe	Val	Lys	Phe	Ala	Ala	Phe	Val	Ala
			180					185					190		
Tyr	His	Leu	Asp	Asp	Leu	Val	Asp	Met	Trp	Ser	Thr	Met	Met	Glu	Pro
		195					200					205			
Met	Val	Val	Tyr	Asn	Gln	Gly	Tyr	Ile	Asn	Leu	Arg	Ser	Gly	Phe	Pro
	210					215					220				
Pro	Gly	Tyr	Leu	Ser	Phe	Glu	Ala	Ala	Glu	Lys	Ala	Lys	Phe	Asn	Leu
225					230					235					240
Ile	Gln	Ala	His	Ile	Gly	Ala	Tyr	Asp	Ala	Ile	Lys	Glu	Tyr	Ser	Glu
				245					250					255	
Lys	Ser	Val	Gly	Val	Ile	Tyr	Ala	Phe	Ala	Trp	His	Asp	Pro	Leu	Ala
			260					265					270		
Glu	Glu	Tyr	Lys	Asp	Glu	Val	Glu	Glu	Ile	Arg	Lys	Lys	Asp	Tyr	Glu
		275					280					285			
Phe	Val	Thr	Ile	Leu	His	Ser	Lys	Gly	Lys	Leu	Asp	Trp	Ile	Gly	Met
	290					295					300				
Asn	Tyr	Tyr	Ser	Arg	Leu	Val	Tyr	Gly	Ala	Lys	Asp	Gly	His	Leu	Val
305					310					315					320
Pro	Leu	Pro	Gly	Tyr	Gly	Phe	Met	Ser	Glu	Arg	Gly	Gly	Phe	Ala	Lys
				325					330					335	
Ser	Gly	Arg	Pro	Ala	Ser	Asp	Phe	Gly	Trp	Glu	Met	Tyr	Pro	Glu	Gly
			340					345					350		
Leu	Glu	Asn	Leu	Leu	Lys	Tyr	Leu	Asn	Asn	Ala	Tyr	Glu	Leu	Pro	Met
		355					360					365			
Ile	Ile	Thr	Glu	Asn	Gly	Met	Ala	Asp	Ala	Ala	Asp	Arg	Tyr	Arg	Pro
	370					375					380				
His	Tyr	Leu	Val	Ser	His	Leu	Lys	Ala	Val	Tyr	Asn	Ala	Met	Lys	Glu
385					390					395					400
Gly	Ala	Asp	Val	Arg	Gly	Tyr	Leu	His	Trp	Ser	Leu	Thr	Asp	Asn	Tyr
				405					410					415	
Glu	Trp	Ala	Gln	Gly	Phe	Arg	Met	Arg	Phe	Gly	Leu	Val	Tyr	Val	Asp
			420					425					430		
Phe	Glu	Thr	Lys	Lys	Arg	Tyr	Leu	Arg	Pro	Ser	Ala	Leu	Val	Phe	Arg
		435					440					445			
Glu	Ile	Ala	Thr	Gln	Lys	Glu	Ile	Pro	Glu	Glu	Leu	Ala	His	Leu	Ala
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Asp	Leu	Lys	Phe	Val	Thr	Arg	Lys								

465

470

<210> 9

<211> 489

<212> PRT

<213> Sulfolobus solfataricus

<400> 9

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Met Tyr Ser Phe Pro Asn Ser Phe Arg Phe Gly Trp Ser Gln Ala Gly
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Phe Gln Ser Glu Met Gly Thr Pro Gly Ser Glu Asp Pro Asn Thr Asp
 20          25          30
Trp Tyr Lys Trp Val His Asp Pro Glu Asn Met Ala Ala Gly Leu Val
 35          40          45
Ser Gly Asp Leu Pro Glu Asn Gly Pro Gly Tyr Trp Gly Met Tyr Lys
 50          55          60
Thr Phe His Asp Asn Ala Gln Lys Met Gly Leu Lys Ile Ala Arg Leu
 65          70          75          80
Asn Val Glu Trp Ser Arg Ile Phe Pro Asn Pro Leu Pro Arg Pro Gln
 85          90          95
Asn Phe Asp Glu Ser Lys Gln Asp Val Thr Glu Val Glu Ile Asn Glu
100          105          110
Asn Glu Leu Lys Arg Leu Asp Glu Tyr Ala Asn Lys Asp Ala Leu Asn
115          120          125
His Tyr Arg Glu Ile Phe Lys Asp Leu Lys Ser Pro Gly Leu Tyr Phe
130          135          140
Ile Leu Asn Met Tyr His Trp Pro Leu Pro Leu Trp Leu His Asp Pro
145          150          155          160
Ile Arg Val Arg Arg Gly Asp Phe Thr Gly Pro Ser Gly Trp Leu Ser
165          170          175
Thr Arg Thr Val Tyr Glu Phe Ala Arg Phe Ser Ala Tyr Ile Ala Trp
180          185          190
Lys Phe Asp Asp Leu Val Asp Glu Tyr Ser Thr Met Met Glu Pro Met
195          200          205
Val Val Gly Gly Leu Gly Tyr Val Gly Val Lys Ser Gly Phe Pro Pro
210          215          220
Gly Tyr Leu Ser Phe Glu Leu Ser Arg Arg His Met Tyr Asn Ile Ile
225          230          235          240
Gln Ala His Ala Arg Ala Tyr Asp Gly Ile Lys Ser Val Ser Lys Lys
245          250          255
Pro Val Gly Ile Ile Tyr Ala Asn Ser Ser Phe Gln Pro Leu Thr Asp
260          265          270
Lys Asp Met Glu Ala Val Glu Met Ala Glu Asn Asp Asn Arg Trp Trp
275          280          285
Phe Phe Asp Ala Ile Ile Arg Gly Glu Ile Thr Arg Gly Asn Glu Lys
290          295          300
Ile Val Arg Asp Asp Leu Lys Gly Arg Leu Asp Trp Ile Gly Met Asn
305          310          315          320
Tyr Tyr Thr Arg Thr Val Val Lys Arg Thr Glu Lys Gly Tyr Val Ser
325          330          335
Leu Gly Gly Tyr Gly His Gly Cys Glu Arg Asn Ser Val Ser Leu Ala
340          345          350
Gly Leu Pro Thr Ser Asp Phe Gly Trp Glu Phe Phe Pro Glu Gly Leu
355          360          365
Tyr Asp Val Leu Thr Lys Tyr Trp Asn Arg Tyr His Leu Tyr Met Tyr
370          375          380
Val Thr Glu Asn Gly Ile Ala Asp Asp Ala Asp Tyr Gln Arg Pro Tyr
385          390          395          400
Tyr Leu Val Ser His Val Tyr Gln Val His Arg Ala Ile Asn Ser Gly
405          410          415
Ala Asp Val Arg Gly Tyr Leu His Trp Ser Leu Ala Asp Asn Tyr Glu

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420 425 430
 Trp Ala Ser Gly Phe Ser Met Arg Phe Gly Leu Leu Phe Val Asp Tyr
 435 440 445
 Asn Thr Lys Arg Leu Tyr Trp Arg Pro Ser Ala Leu Val Tyr Arg Glu
 450 455 460
 Ile Ala Thr Asn Cys Ala Ile Thr Asp Glu Ile Glu His Leu Asn Ser
 465 470 475 480
 Val Pro Pro Val Lys Pro Leu Arg His
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<220>
 <223> Consensus

<400> 10
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 20 25 30
 Pro Glu Gly Asn Trp Glu Leu Tyr Asp His Ala Lys Leu Gly Leu Asn
 35 40 45
 Ala Tyr Arg Ile Glu Trp Ser Arg Ile Phe Pro Pro Thr Val Glu Ile
 50 55 60
 Val Glu Leu Glu Leu Ala Asn Ala His Tyr Arg Ile Leu Lys Pro Gly
 65 70 75 80
 Thr Ile Val Asn Leu His Thr Leu Pro Asp Trp His Asp Pro Ile Arg
 85 90 95
 Gly Trp Leu Glu Arg Thr Val Glu Phe Ala Lys Tyr Ala Ala Tyr Val
 100 105 110
 Ala Lys Phe Asp Asp Val Asp Trp Ser Thr Phe Asn Glu Pro Met Val
 115 120 125
 Val Leu Gly Tyr Leu Tyr Ser Gly Phe Pro Pro Gly Leu Ser Pro Glu
 130 135 140
 Ala Ala Lys Asn Ile Ala His Ala Ala Tyr Asp Ile Lys Ser Lys Pro
 145 150 155 160
 Val Gly Ile Ile Tyr Asn Asp Pro Lys Asp Ala Ala Glu Phe Glu Ala
 165 170 175
 Ile Gly Glu Pro Asp Trp Ile Gly Met Asn Tyr Tyr Thr Arg Val Val
 180 185 190
 Glu Leu Pro Gly Tyr Gly Leu Ser Pro Ser Asp Phe Gly Trp Glu Tyr
 195 200 205
 Arg Glu Gly Leu Tyr Asp Leu Ala Tyr Pro Tyr Ile Thr Glu Asn Gly
 210 215 220
 Thr Ala Asp Asp Pro Pro Tyr Ile Ser His Val Lys Ala Ile Glu Gly
 225 230 235 240
 Asp Val Pro Gly Tyr Phe His Trp Ser Leu Thr Asp Asn Tyr Glu Trp
 245 250 255
 Ala Gly Glu Met Arg Glu Gly Leu Glu Val Asp Thr Lys Glu Arg Pro
 260 265 270
 Arg Ser Ala Val Tyr Arg Glu Ile Ala Ile Glu Leu Arg
 275 280 285